

MEMORANDUM



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To: Rick Clegg, IDEQ

cc: Bob Geddes, P₄ Production, LLC

From: Bill Wright, MWH

Reference: P₄ Production Southeast Idaho
Mine-Specific Selenium Program
(1010076.011601)

Subject: Chromium Speciation Sampling in Sediment, Riparian Soil, and Waste Rock Dump Soil

Introduction

The purpose of this memorandum is to document the stations and media to be sampled for chromium speciation in 2004 as part of the P₄ Production Southeast Idaho Mine-Specific Selenium Program. This memorandum has been prepared with input from IDEQ. This activity supports the site investigations at P₄ Production's Enoch Valley, Henry, and Ballard mines. This activity, chromium speciation, is being conducted to determine the local or mine-specific ratio of hexavalent chromium (Cr[VI]) to total chromium in sediment, riparian soil, and waste rock dump soil.

Background

The reason determining the ratio of Cr(VI) is important is because the preliminary risk-based benchmark being used by the regulatory agency for chromium is the Region 9 Preliminary Remedial Goal (PRG) for total chromium. This preliminary benchmark assumes, unrealistically, that one-seventh (approximately 14%) of the chromium is present in the far more toxic hexavalent state. Trivalent chromium, the typical form found in the environment, is virtually non-toxic; in fact, it is a mineral widely used in high doses as a nutritional supplement. Trivalent chromium occurs naturally in rocks, soil, plants, animals, and volcanic emissions. This form is believed by many to play a nutritional or pharmaceutical role in the body, but its mechanism of action is unknown.

Hexavalent chromium is produced industrially when trivalent chromium (Cr[III]) is heated in the presence of mineral bases and atmospheric oxygen (for instance, during metal finishing processes). It is this form of chromium that has proven to be of the greatest occupational and environmental health concern. Hexavalent chromium is unstable under environmental conditions and is encountered as a contaminant under conditions where large quantities of the hexavalent form is used in an industrial process or when trivalent chromium is converted to hexavalent chromium under industrial processes.

It is for the above reasons, and the fact that there are no industrial processes using chromium at

the mines under consideration, that the PRG assumed ratio is unrealistic. We believe the fraction of Cr(VI) is closer to 0% than the 14% assumed by EPA Region 9. The purpose of this

activity is to establish the actual mine-specific ratio of hexavalent chromium to total chromium in sediment, riparian soil, and waste rock dump soil. Chromium in other environmental media is not of concern.

Sediment

Historical total chromium results in sediment for stations relating to P₄ Production's mines were reviewed. One pond station from each of the three mines (i.e., three total ponds stations) and three stream stations, with the highest total chromium concentrations during the May 2002 interim surface water and sediment sampling event, were chosen for chromium speciation sampling for sediment.

The three pond stations (i.e., one station from each mine) with the highest total chromium in sediment are as follows:

- MSP059 (Ballard Mine Pit #4 Stock Pond) at 700 mg/kg dw,
- MSP055 (Henry Mine South Pit Pond) at 610 mg/kg dw, and
- MSP019 (Enoch Valley Mine Bat Cave Pond) at 580 mg/kg dw.

The three stream stations with the highest total chromium in sediment are as follows:

- MST130 (Angus Creek, below Angus Creek Reservoir) at 78 mg/kg dw,
- MST089 (Wooley Valley Creek, below North Fork Wooley Valley Creek) at 76 mg/kg dw, and
- MST067 (Ballard Creek, headwaters) at 76 mg/kg dw.

Riparian Soil

No historical chromium data for riparian soil exists for the P₄ Production mines. Therefore, riparian soil sampling will occur at the three stream stations that exhibited the highest total chromium in sediment and are listed above. One randomly selected composite soil sample will be collected at each location.

Waste Rock Dump Soil

Historical chromium data from waste rock dump soil sampling in Spring 2001 was reviewed. Black-shales on waste rock dumps will be sampled since the sampling in Spring 2001 was biased towards them. One black-shale sample will be collected from a waste rock dump at each of the three P₄ Production mines (i.e., three waste rock dump soil samples will be collected). One waste rock dump location from each mine with the highest concentration of total chromium will be sampled.

The three Spring 2001 waste rock dump stations (i.e., one station from each mine) with the highest total chromium in black shale soils are as follows:

- MWD091-2 (Enoch Valley Mine South Dump) at 1,400 mg/kg dw,
- MWD086-0 (Henry Mine Pit #1 Overburden Dump) at 1,100 mg/kg dw, and
- MWD080-6 (Ballard Mine Pit #1 Overburden Dump #1) at 1,100 mg/kg dw.

The stream and pond sampling stations and the waste rock dump locations specified above can be found on Figure 2-1, "Program Sampling Locations," of the SAP.

Sampling and Analysis Procedures

Sampling procedures for this activity will be in accordance with the P₄ Production Southeast Idaho Mine-Specific Selenium Program, sampling and analysis plan (SAP), project work plans (PjtWPs), and project field sampling plans (PjtFSPs) supporting the site investigations (published 2004). Specifically, sampling procedures are detailed in the program Quality Assurance Plan (PgmQAP) of the SAP and relevant standard operating procedures (SOPs). Sediment sampling procedures are detailed in Section 6.2.6 of the PgmQAP and SOP-NW-9.3, "Collection of Sediment Samples", riparian soil sampling procedures are detailed in Section 6.4.1 of the PgmQAP and SOP-NW-7.2, "Collection of Soil Samples", and waste rock dump soil sampling procedures will be consistent with the procedures followed for the Spring 2001 Area-Wide Investigation waste rock dump soil (i.e., black shales) sampling and SOP-NW-7.2, "Collection of Soil Samples". The procedure for the Spring 2001 Area-Wide Investigation waste rock dump soil sampling included locating an area of exposed black-shales upon a waste rock dump, obtaining GPS coordinates, digging an approximately 1-ft deep hole and obtaining the sample by scraping the face of the hole. No sieving in the field was performed.

The pond and stream sediment samples, the riparian soil samples, and the waste rock dump soil (i.e., black shales) samples will be analyzed at the University of Idaho, Holm Research Center, for total chromium by ICP (EPA 3050/6010) with a method detection limit (MDL) of 0.38 mg/kg dw and hexavalent chromium by alkaline digest & colorimetric analysis (EPA 3060/7196) with a MDL of approximately 0.10 mg/kg dw.

Data Evaluation

The mean percent hexavalent chromium and confidence and tolerance bounds will be calculated by medium. The mine-specific ratio of hexavalent chromium to total chromium in sediment, riparian soil, and waste rock dump soil will be determined from these results. This activity assumes that the fraction of hexavalent chromium is variable but in a way that is not dependent on the total chromium concentrations. In other words, locations with high concentrations of total chromium are being targeted in anticipation of seeing very low amounts of hexavalent chromium.

The sample results, and findings from this activity (i.e., mine-specific chromium ratio) will be reported in the SI report. If the results are as predicted, P₄ Production may use them as a basis for deleting chromium from the list of contaminants of potential concern.